

(12) UK Patent Application (19) GB (11) 2 326 756 (13) A

(43) Date of A Publication 30.12.1998

(21) Application No 9811968.8

(22) Date of Filing 03.06.1998

(30) Priority Data

(31) 09149387 (32) 06.06.1997 (33) JP

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(51) INT CL⁶

G11B 5/53 20/24

(52) UK CL (Edition P)

G5R RB35 RB84

(56) Documents Cited

GB 2272100 A GB 2191327 A EP 0660305 A2
WO 93/04470 A1 US 4851935 A

(58) Field of Search

UK CL (Edition P) G5R RB35 RB84 RKL RKY
INT CL⁶ G11B 5/52 5/53 20/24
ONLINE: WPI, JAPIO, CLAIMS

(54) Abstract Title

Low-noise power supply arrangement for a rotary head amplifier

(57) A signal from a reproduction head 11 of a rotary head 10 is supplied via a reproduction initial stage amplifier 12 and via windings 22b and 22a of a rotary transformer 20 to a reproduction system 41 of the fixed side. Power from a power supply circuit 30 is supplied via windings 21a and 21b of the rotary transformer 20 to a rectifier circuit 15. A rectified output from the rectifier circuit 15 is supplied via a capacitor 16 for power accumulation and a regulator 17 to the reproduction initial stage amplifier 12. During a reproduction operation of the reproduction head 11, a control circuit 42 halts power supply from the power supply circuit 30 and power accumulated in the capacitor 16 is supplied to the reproduction initial stage amplifier 12.

This prevents the adverse noise effect of power transmission on the reproduction channel.

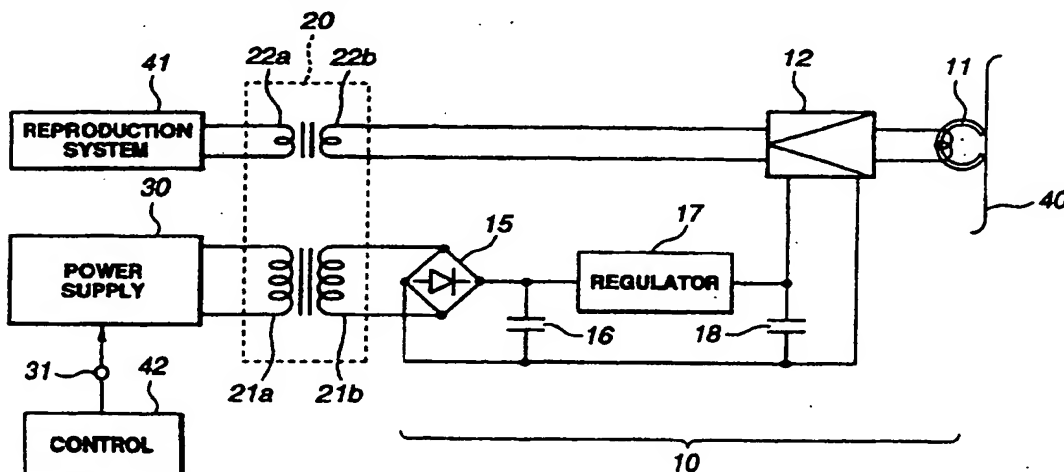


FIG.12

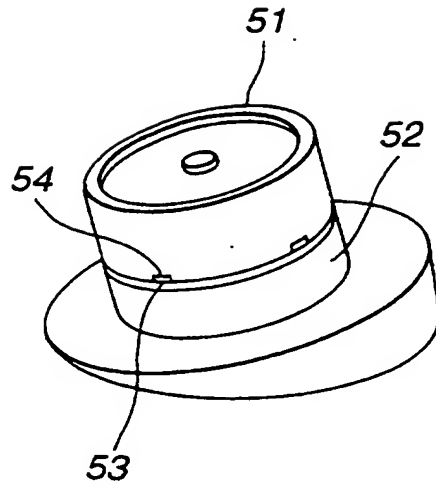


FIG.1

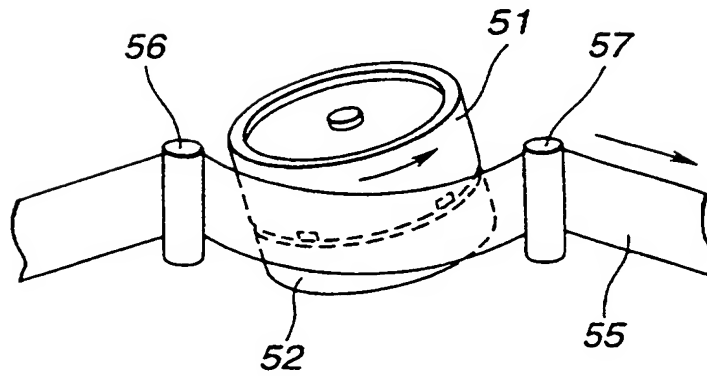
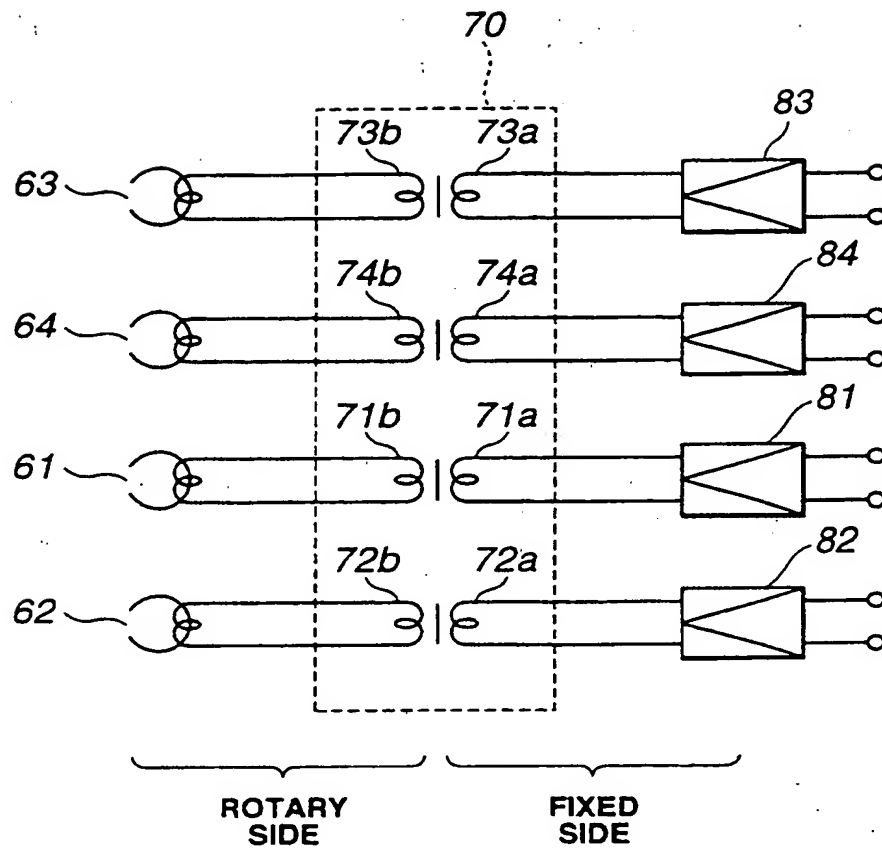


FIG.2

**FIG.3**

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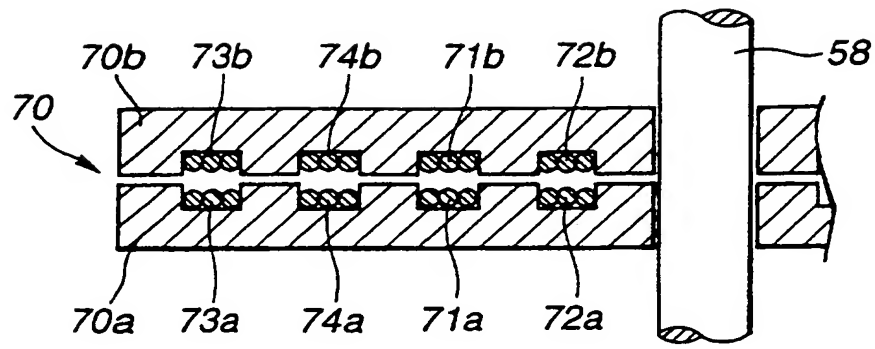


FIG.4

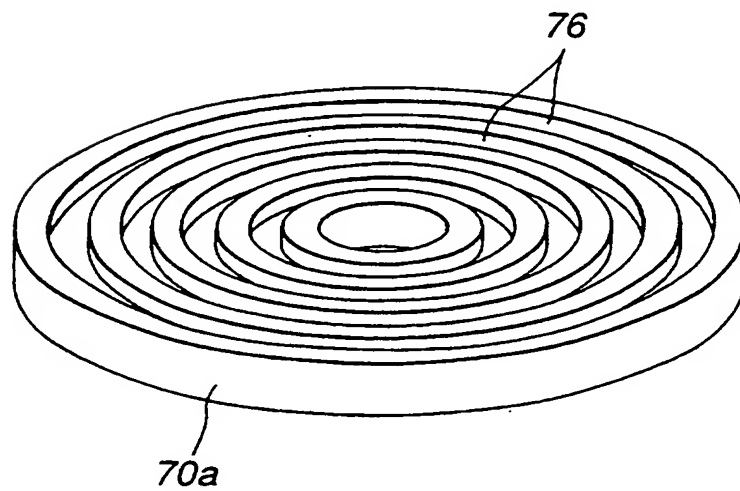


FIG.5

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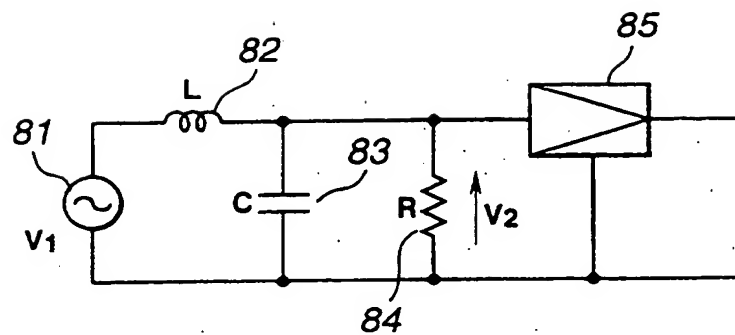


FIG.6

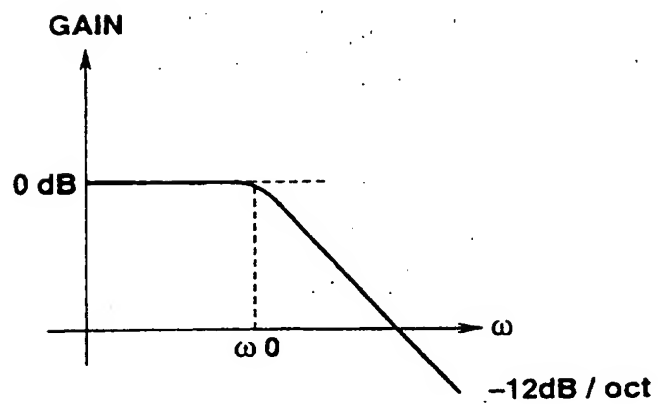


FIG.7

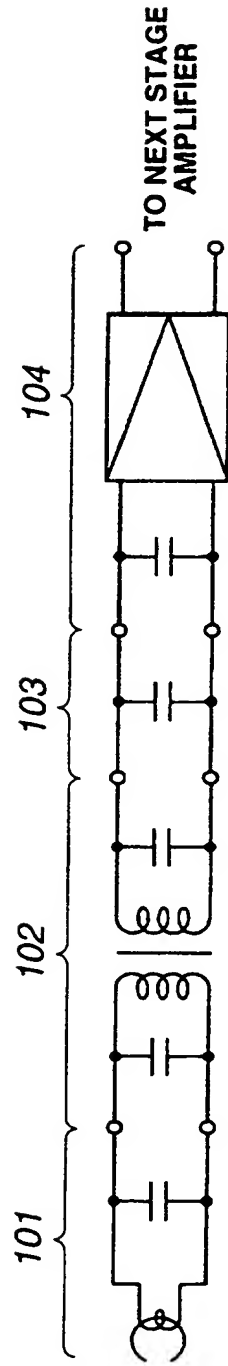


FIG. 8B

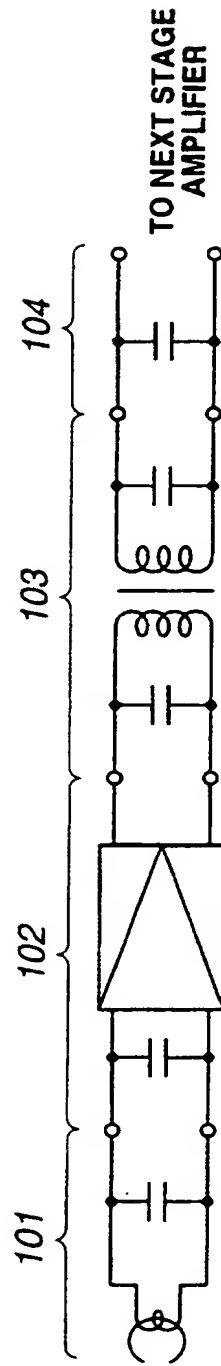


FIG. 8A

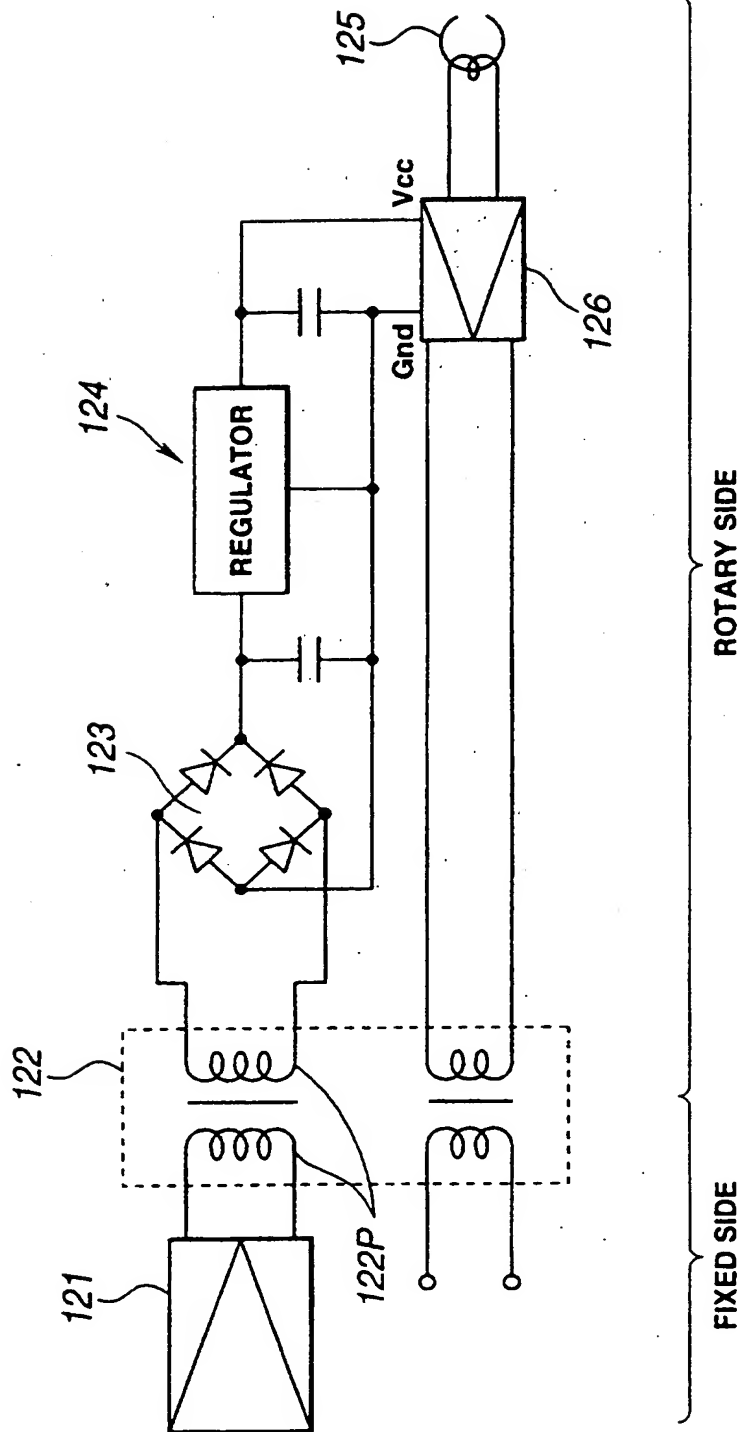
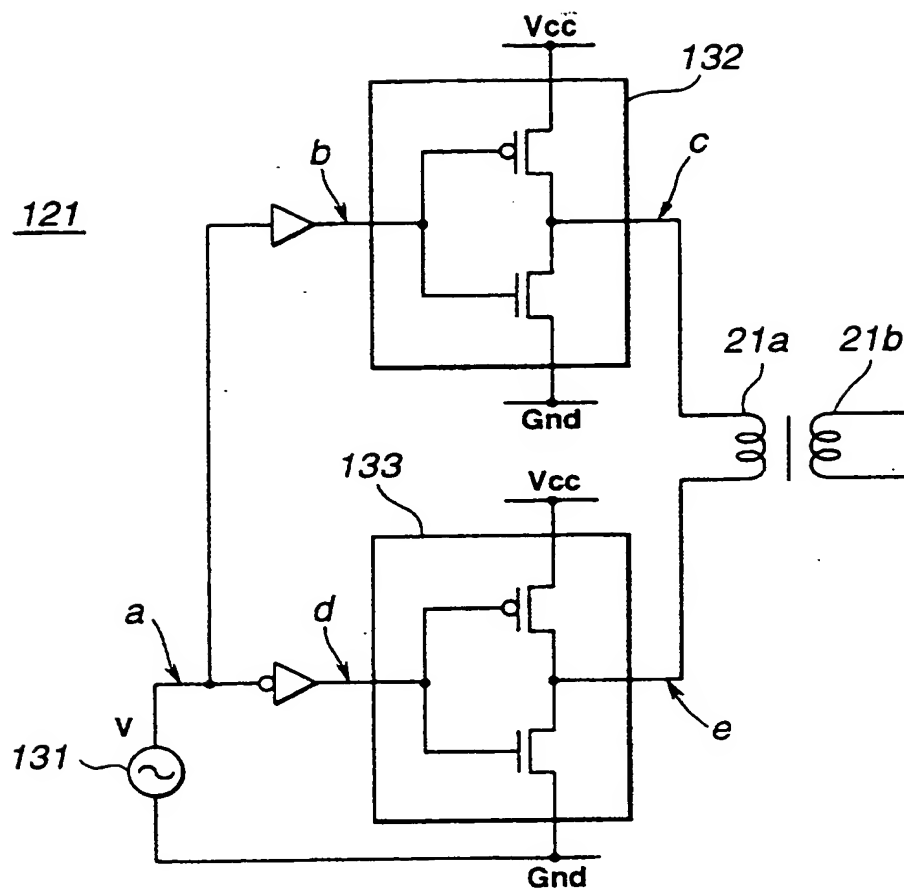
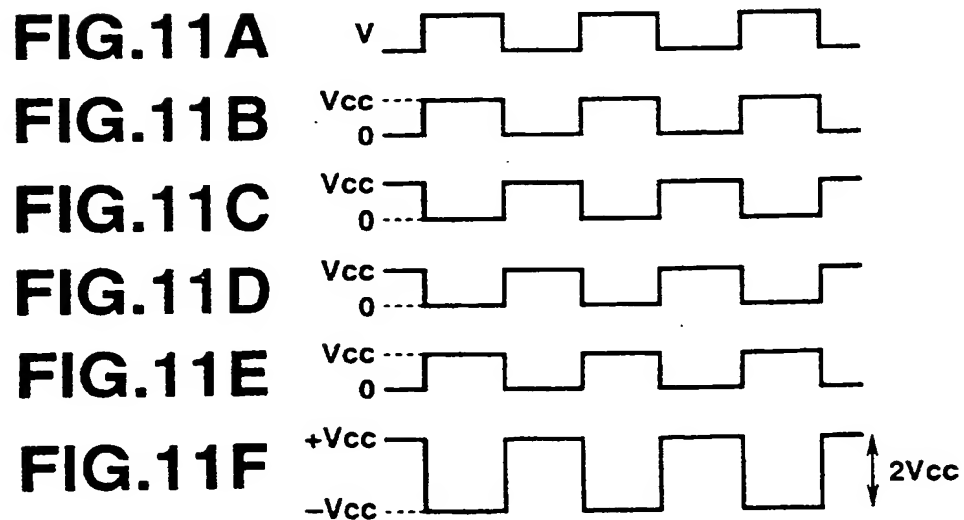


FIG.9

**FIG.10**

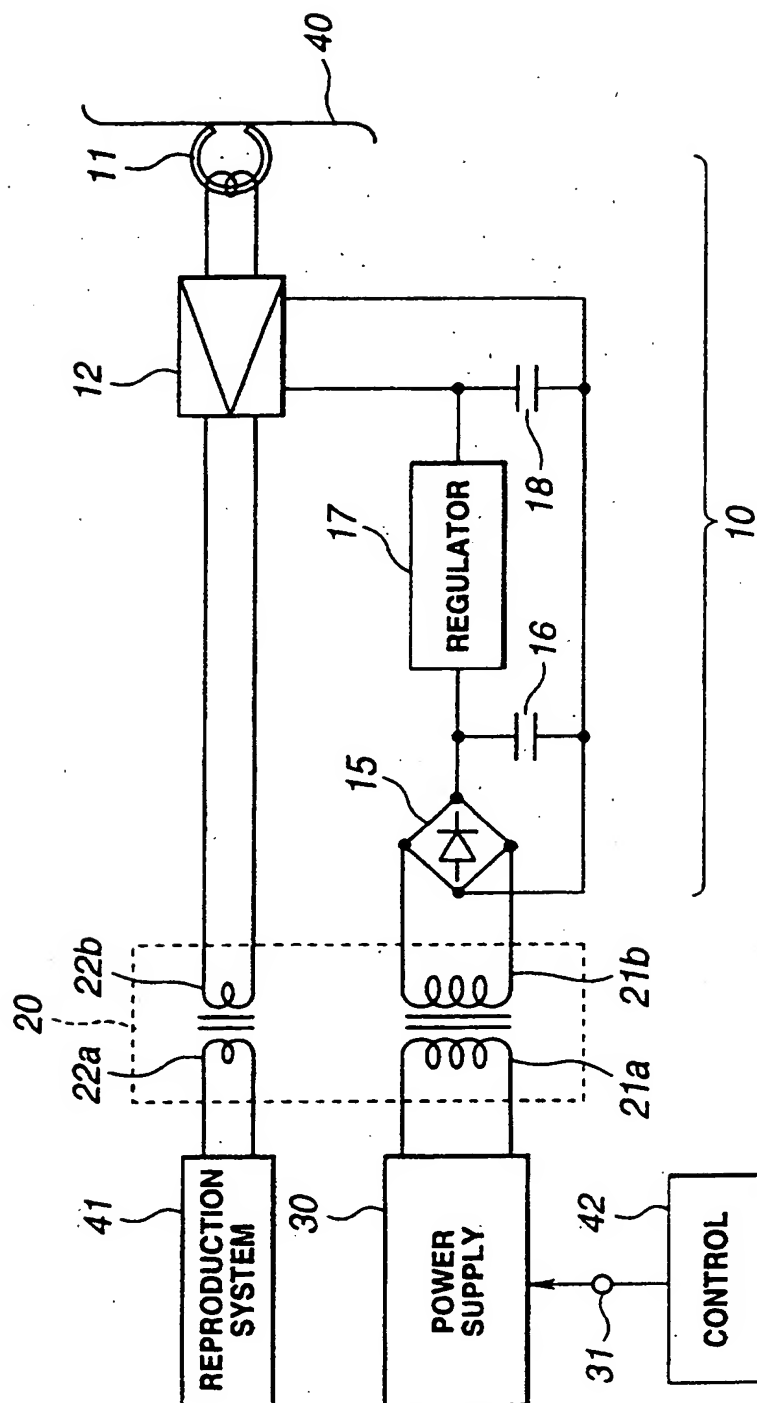


FIG. 12

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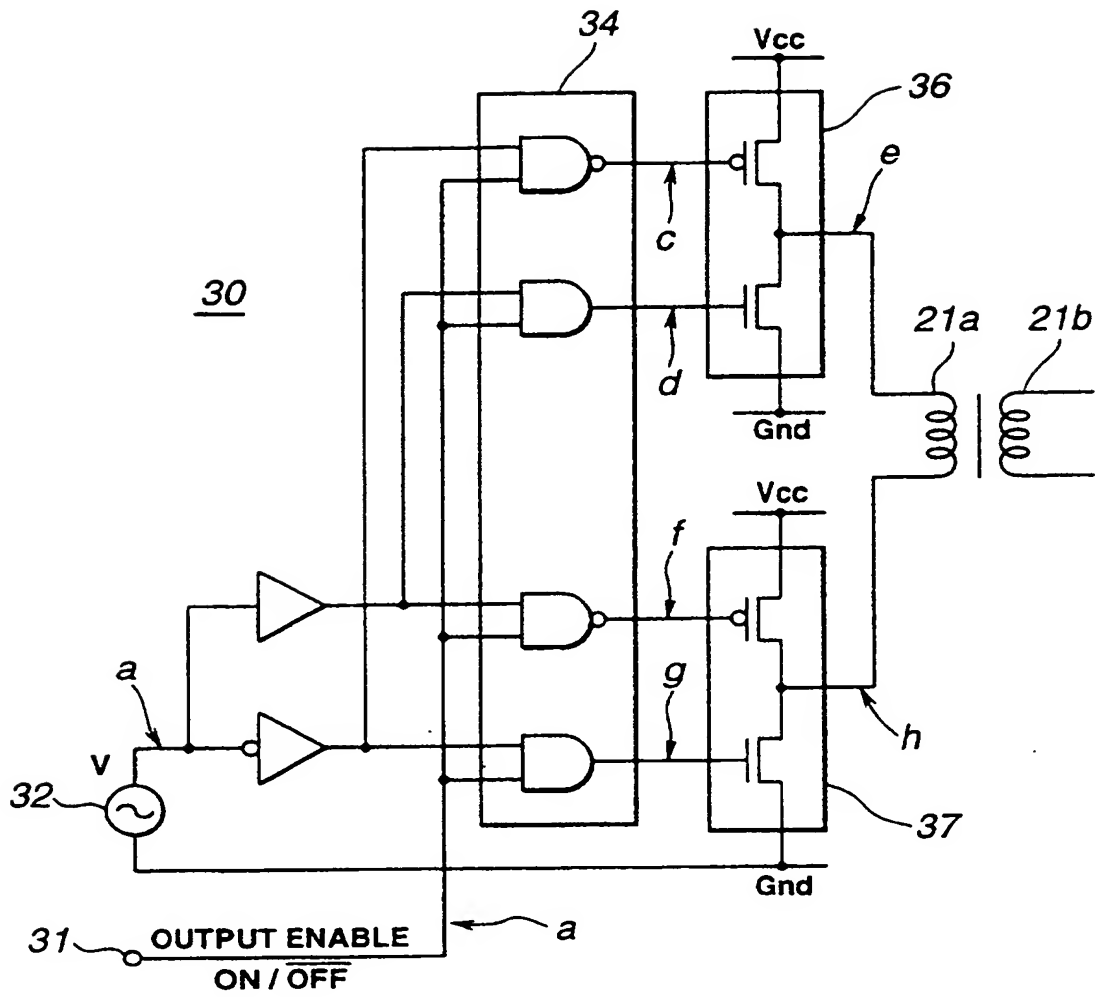
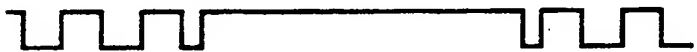
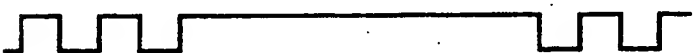
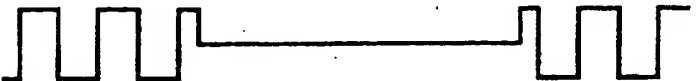


FIG.13

FIG.14A**OUTPUT
ENABLE****FIG.14B****v****FIG.14C****FIG.14D****FIG.14E****HIGE IMPEDANCE****FIG.14F****FIG.14G****FIG.14H****HIGE IMPEDANCE****FIG.14 I**

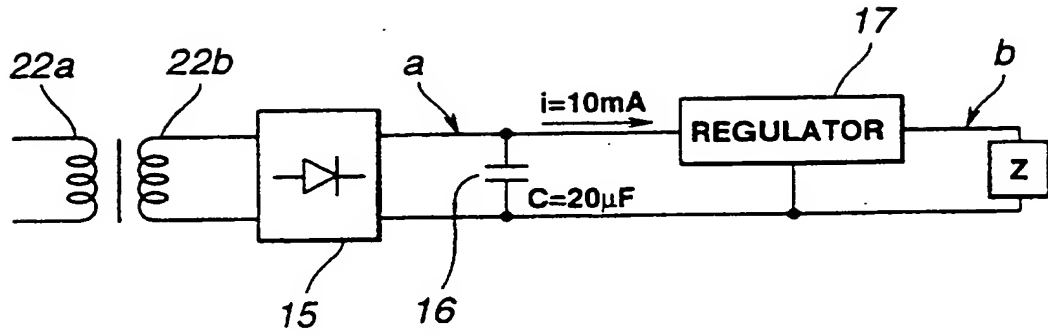


FIG.15

FIG.16A

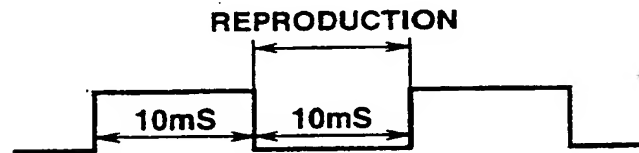
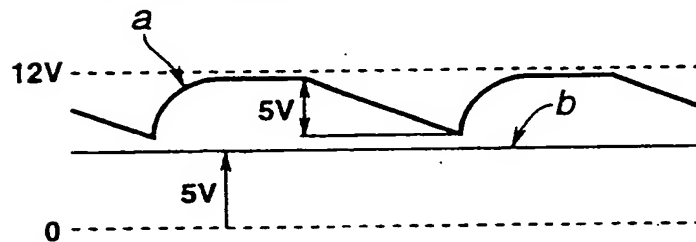


FIG.16B



FIG.16C



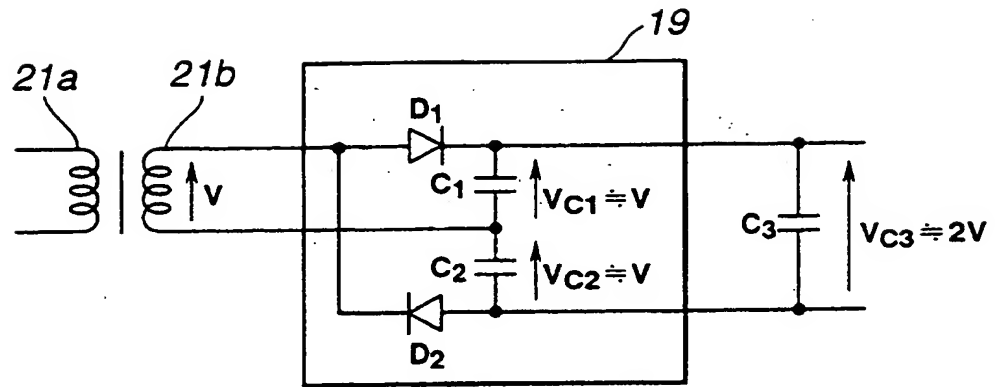


FIG.17

FIG.18A

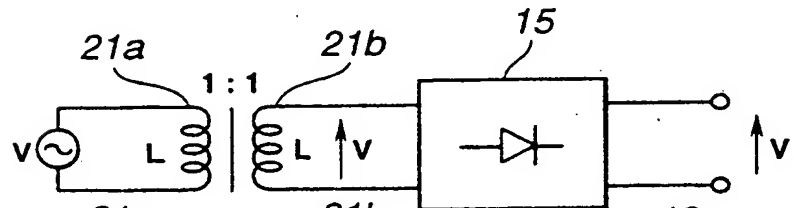


FIG.18B

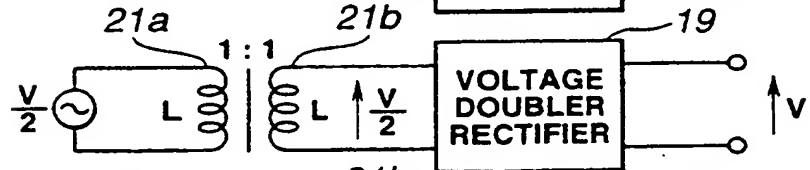
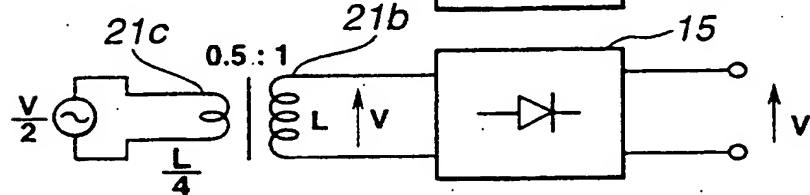


FIG.18C



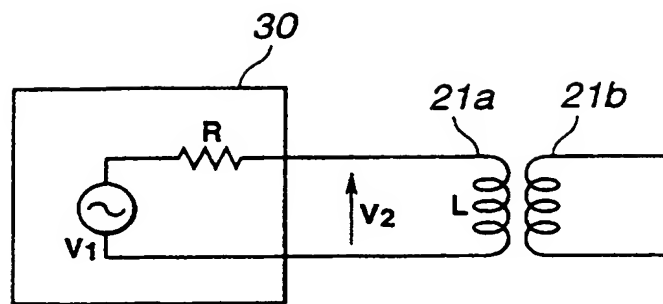


FIG.19

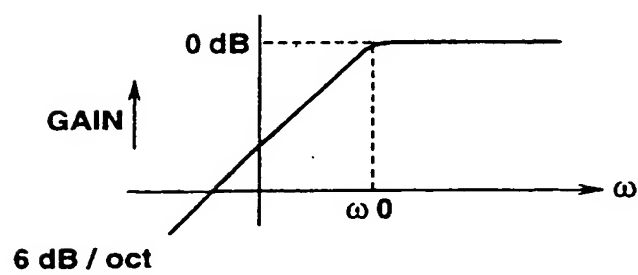


FIG.20

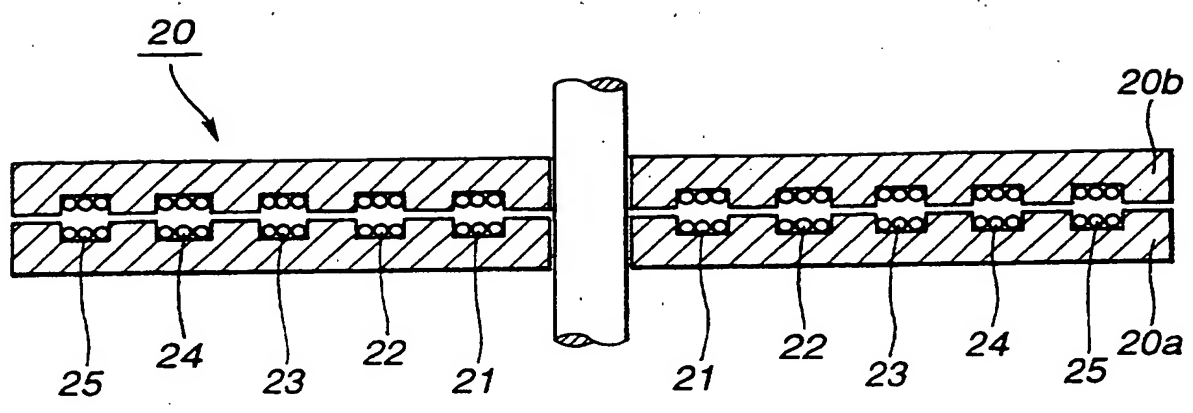


FIG.21

SIGNAL REPRODUCTION APPARATUS AND METHOD

The present invention relates to a signal reproduction apparatus and method in which a signal transmission between a rotary portion and a fixed portion of a rotary head apparatus is carried out via a rotary transformer and in particular, to a signal reproduction apparatus and method involving a rotary drum having a reproduction amplifier.

In a DAT (digital audio tape recorder), VTR, and the like, a so-called helical scan type rotary head apparatus is known. Fig. 1 of the accompanying drawings shows a brief configuration of such a helical scan type rotary head apparatus as an example, including a rotary drum 51 and a fixed drum 52. A magnetic head 53 for recording and reproduction is arranged so as to be exposed through a window 54 at the outer circumference of the rotary drum 51.

Fig. 2 shows a guide running state of a magnetic tape 55. The magnetic tape 55 is guided and driven to run in an inclined direction along the outer circumference of the rotary drum 51 and the fixed drum 52. The magnetic head of the rotary drum 51 carries out recording/reproduction while scanning the magnetic tape 55 in an inclined direction with respect to the tape running direction.

Transmission of a recording/reproduction signal for the recording/reproduction head of the rotary drum is carried out via a rotary transformer. A recording output amplifier and a reproduction initial stage amplifier are normally arranged out of the drum.

Fig. 3 is a block diagram showing a circuit for connection between the recording/reproduction head of the rotary drum and the recording/reproduction amplifier. In Fig. 3, reproduction heads 61, 62 arranged at the rotary side such as the aforementioned rotary drum are respectively connected via windings 71, 72 of the rotary transformer 70 to reproduction initial stage amplifiers 81, 82 of the fixed side, whereas recording heads 63, 64 of the rotary side are respectively connected via windings 73, 74 of the rotary transformer 70 to recording amplifiers 83, 84 of the fixed

side. It should be noted that in Fig. 3, each of the windings of the rotary transformer 70 is denoted by a reference numeral having a subscript "a" for the fixed side and a subscript "b" for the rotary side.

5 Fig. 4 is a cross sectional view showing the rotary transformer 70 as an example including a fixed side core 70a and a rotary side core 70b which are arranged to oppose each other via a clearance. Each of the cores, as shown in Fig. 5, has concentric a number of circular grooves 76
10 corresponding to a number of recording/reproduction channels formed on the opposing sides. The windings 71a to 74a are mounted in the grooves of the fixed side and the windings 71b to 74b are mounted in the grooves of the rotary side. In the rotary transformer 70 having the aforementioned
15 configuration, the clearance present between the cores 70a and the 70b causes a large transmission loss compared to a transformer having no clearance.

 The transmission loss of this rotary transformer 70 results in a reduction of an already weak reproduction head
20 output signal, which in turn reduces the signal ratio with respect to an amplifier noise, so-called SN ratio, deteriorating the quality of the amplifier output signal.

 Next, Fig. 6 shows a circuit configuration equivalent to a circuit from the reproduction head to the
25 reproduction initial stage amplifier. A signal source 81 represents a reproduction head electro motive force voltage v_1 , and a coil 82 represents a head inductance L . A capacitor 83 represents a capacity C as a total of the amplifier input capacity, the wiring capacity, and the rotary
30 transformer capacity. A resistor 84 represents a resistance component in parallel to the head L in addition to a parallel synthesis value R of a dumping resistance. These are connected to an input side of the reproduction initial stage amplifier 85.

35 As is clear from this Fig. 6, the head inductance L and the capacity C at the amplifier input terminal constitute a low pass filter. This low pass filter brings about a cut-off frequency ω_0 having a characteristic as shown in Fig. 7 which determines an upper limit of a frequency band of

this system. It should be noted that the aforementioned cut-off frequency ω_0 is, for example, as follows:

$$\omega_0 = 1 / (LC)$$

The capacitance C obtained at the amplifier input side includes an input capacity of the amplifier itself to which is also added a capacity parallel to the windings of the rotary transformer as well as the winding capacity between the head and the rotary transformer and between the rotary transformer and the amplifier, which may be greater than the input capacity of the amplifier itself, limiting the frequency band.

To cope with this, there is a case when the reproduction initial stage amplifier is provided on the rotary drum.

This enables to eliminate attenuation of the reproduction signal due to the aforementioned loss in the rotary transformer as well as to reduce the capacity of the amplifier input side, extending the frequency band.

That is, Fig. 8A shows a case when a reproduction initial stage amplifier 104 is provided at the fixed side. In this case, between a reproduction head 101 and a reproduction initial stage amplifier 104, there are connected in parallel the rotary transformer 102 and a cable 103. Fig. 8 B shows a case when a reproduction initial stage amplifier 112 is provided at the rotary side. In this case, a reproduction head 111 is provided in the vicinity of a reproduction initial stage amplifier 112, in which the amplifier input side has a capacity which is almost determined by the input capacity of the amplifier itself, increasing the cut-off frequency of the low pass filter, which in turn extends the frequency band.

In the aforementioned case when the reproduction initial stage amplifier is provided at the rotary side, it is necessary that the amplifier operation power source power be supplied to the rotary drum side. For this, there is a known technique for transmitting power via the rotary transformer.

In this case, as shown in Fig. 9, a power transmission channel is added besides the recording/reproduction channels. That is, a power signal

from a power supply driver 121 is supplied via a winding 122P of a rotary transformer 122 to a rectifier circuit 123 for power supply via a smoothing - voltage stabilizing block 124 to a reproduction initial stage amplifier 126. The reproduction initial stage amplifier 126 amplifies a reproduction signal from a reproduction head 125 and transmits the amplified signal via the rotary transformer 122 to the fixed side.

Fig. 10 shows a configuration example of the power supply driver 121 of Fig. 9. Power from an AC power source 131 is supplied via a CMOS driver circuits 132 and 133 to the fixed side winding of the rotary transformer. Respective portions a to e in Fig. 10 have signal waveforms as shown in Fig. 11A to Fig. 11E. Fig. 11F shows a push-pull output from the two CMOS driver circuits 132 and 133 supplied to the fixed side winding of the rotary transformer, which is equivalent to a difference between the aforementioned signals c and e, i.e., $c - e$.

However, the configuration as shown in Fig. 9 has a problem that a signal in the power transmission channel, passing through the rotary transformer windings or air, reaches the recording/reproduction signal system, lowering the signal SN ratio. Especially, this significantly affects the reproduction head output which is a weak signal.

It is therefore an object of the present invention to provide a signal reproduction apparatus and method which enable to prevent adverse affect from the power transmission channel even if the reproduction initial stage amplifier is provided at the rotary side of the rotary head apparatus.

According to the present invention there is provided a signal reproduction apparatus comprising:

a rotary head block including: a reproduction head along which, in use, a tape-shaped recording medium is applied, so that at least reproduction operation is carried out intermittently according to the rotation; a reproduction initial stage amplifier connected to said reproduction head; a rectifier circuit for supplying electric power to said reproduction initial stage amplifier; and power accumulation means for accumulating electric power to be supplied from

said rectifier circuit to said reproduction initial stage amplifier and supplying accumulated power to said reproduction initial stage amplifier when no power is supplied from said rectifier circuit;

5 a rotary transformer for transmitting at least an output signal of said reproduction initial stage amplifier from said rotary head block and a power signal to said rectifier circuit; and

10 a power supply circuit for supplying said electric signal to said rotary transformer and stops the supply of said power signal during a reproduction operation of said reproduction head of said rotary head block.

15 The rotary head block may be provided with not only the reproduction head but also a reproduction head, but the recording operation and the reproduction operation should not function simultaneously.

20 The aforementioned rotary transformer carries out transmission of signals of all the channels to the aforementioned rotary head block by using a plurality of pairs of windings within a transformer and it is preferable that the channels be arranged in the order of a power signal, reproduction signal, and recording signal in the radial direction from centre to outside.

25 Moreover, the aforementioned rectifier circuit of the rotary head block is preferably a voltage doubling rectifier circuit for multiplying an input voltage for output.

30 As no power transmission is carried out during a reproduction channel signal transmission, it is possible to prevent an adverse affect from the power transmission signal to a weak reproduction head output.

 The invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

35 Fig. 1 is a perspective view showing a simplified configuration of a helical scan type rotary head apparatus.

 Fig. 2 is a perspective view showing a guided tape running state in a helical scan type rotary head apparatus.

Fig. 3 is a circuit diagram schematically showing a connection state between a rotary drum recording/reproduction head and a recording/reproduction amplifier.

Fig. 4 is a cross sectional view showing an essential portion of a rotary transformer as an example.

Fig. 5 is a perspective view showing a simplified configuration of a core of the rotary transformer.

Fig. 6 is a circuit diagram showing a circuit configuration equivalent to a circuit from a reproduction head to a reproduction initial stage amplifier.

Fig. 7 shows an example of frequency characteristic of the equivalent circuit of Fig. 6.

Fig. 8A shows an equivalent circuit diagram in which a reproduction initial stage amplifier is provided at a fixed side; and Fig. 8B shows an equivalent circuit diagram in which a reproduction initial stage amplifier is provided at a rotary side.

Fig. 9 is a block diagram for explaining a power supply when the reproduction initial amplifier is provided at the rotary side.

Fig. 10 is a circuit diagram schematically showing a configuration example of a power supply driver of Fig. 9.

Fig. 11 is a timing chart showing operation waveforms of respective portions in Fig. 10.

Fig. 12 is a block diagram showing a configuration example of an embodiment of the present invention.

Fig. 13 is a block diagram showing a configuration example of a power supply circuit of Fig. 12.

Fig. 14 is a timing chart showing waveforms at respective portions of the power supply circuit in Fig. 13.

Fig. 15 is a block diagram for explaining power supply in the rotary head portion.

Fig. 16 shows waveforms for explanation of power supply operation in the rotary head portion.

Fig. 17 is a block diagram showing a configuration example of a voltage doubling rectifier circuit.

Fig. 18 shows equivalent circuit diagrams schematically showing some examples of power supply via a rotary transformer.

Fig. 19 is an equivalent circuit diagram for explaining a high pass filter formed by a power supply circuit and a rotary transformer.

Fig. 20 shows an example of frequency
5 characteristic of the high pass filter formed by the power supply circuit and the rotary transformer.

Fig. 21 is a cross sectional view showing an example of arrangement of a power channel winding, a reproduction channel winding, and a recording channel winding
10 of the rotary transformer.

Hereinafter, description will be directed to a signal reproduction apparatus according to a preferred embodiment of the present invention with reference to the attached drawings.

15 Fig. 12 shows an example of signal reproduction apparatus according to an embodiment of the present invention.

In this Fig. 12, a rotary head block 10 is a block which is provided on the aforementioned rotary drum and a
20 rotary disc. This block constitutes together with the aforementioned fixed drum a cylindrical body, along which a magnetic tape 40 as a tape-shaped recording medium is guided to travel. According to its rotation, a reproduction head 11 slides along the magnetic tape for reproduction operation.
25 Here, the reproduction operation of the reproduction head 11 is carried out within a period of time while the reproduction head 11 is in contact with the magnetic tape 40. For example, in a case of 90 winding, for each one rotation period, reproduction operation is intermittently carried out
30 at a time ratio of 1/4 of the period. It should be noted that in a case when a plurality of reproduction heads are provided, the reproduction operation is successively carried out within a period of time while each of the reproduction head is in contact with the magnetic tape within one rotation
35 period. In the present embodiment, it is assumed that the reproduction operation by a reproduction head is intermittently carried out and there exists a period during which no reproduction operation is carried out.

The rotary head block 10 in Fig. 12, besides the reproduction head 11 where, as has been described above, a reproduction operation is intermittently carried out according to the rotation, includes: a reproduction initial stage amplifier 12 connected to this reproduction head 11; a rectifier circuit 15 for supplying power to this reproduction initial stage amplifier 12; and a capacitor 16 for accumulating power from the rectifier circuit 15 to the reproduction initial stage amplifier 12, so that the accumulated power is supplied to the reproduction initial stage amplifier 12 when no power is supplied from the rectifier circuit 15. The capacitor 16 also serves as a smoothing capacitor for smoothing a rectified output from the rectifier circuit and is connected to a regulator 17 for stabilizing the power source voltage, so that a stable power source power can be supplied via a capacitor 18 to the reproduction initial stage amplifier. Besides, the rotary head block 10 is provided with another set of a reproduction head and a reproduction initial stage amplifier as well as recording heads for two channels and a recording/reproduction head instead of recording-dedicated head and a reproduction-dedicated head, but these are not related to the scheme of the present invention and omitted in the explanation and in the figures.

A rotary transformer 20 is provided for transmission of an output signal from the reproduction initial stage amplifier 12 of the rotary head block 10 and a power signal to the rectifier circuit 15. The rotary transformer 20 has windings 21b and 22b of the rotary side which are arranged to oppose to the windings 21a and 22a, respectively, so as to be electromagnetically connected to each other. The winding 21b of the rotary side is connected to the rectifier circuit 15, and the winding 22b of the rotary side is connected to the reproduction initial stage amplifier 12.

Moreover, at the fixed side, a power supply circuit 30 is provided for supplying the aforementioned power signal to the rotary transformer 20 and stops supply of the power signal during a reproduction operation of the reproduction

head 11 of the rotary head block 10. The power signal from this power supply circuit 30 is supplied to the fixed side winding 21a of the rotary transformer 20. The power supply circuit has a control terminal 31 which is supplied with a power supply stop control signal from a control circuit 42. Moreover, the fixed side winding 21a of the rotary transformer 20 is connected to a signal reproduction system circuit block 41 for RF demodulation, error detection and correction, and the like.

The power supply circuit 30, for example, may have a configuration as shown in Fig. 13. In this Fig. 13, the control terminal 31 is supplied with an output enable signal a for stop control of power supply. Fig. 14A shows an example of this output enable signal "a". Moreover, an AC power source (oscillator) 32 transmits an output signal "b" (voltage v) as shown in Fig. 3B having a frequency, for example, in the order of several tens to several hundreds kHz. This output signal "b" is transmitted while partially reversed to a gate control circuit 34. The gate control circuit 34 has an AND gate and a NAND gate, and shuts out the input signal if the output enable signal a from the control terminal 31 is "L" (low level) and passes the input signal if the output enable signal a is "H" (high level). This gate control circuit 34 transmits output signals c, d, f, g which are respectively fed to CMOS driver circuits 36 and 37. Furthermore, an output signal "e" from the CMOS driver circuit 36 is supplied to one of the terminals of the fixed side winding 21a of the rotary transformer 20, whereas an output signal "h" from the CMOS driver circuit 37 is supplied to the other terminal of the aforementioned fixed side winding 21a. Thus, a difference of these output signals e and h, i.e., $e - h$ is applied between the two terminals of this fixed side winding 21a. Fig. 14C to Fig. 14H show examples of these signals c to h, and Fig. 14I shows an example of the signal $e - h$.

Here, When the aforementioned output enable signal a has become "L" and the input signal is shut out by the gate control circuit 34, the respective output signals c, d, f, g from the gate control circuit 34 are, for example, as shown

in Fig. 14C, D, F, G, i.e., the signals c and f to respective P channel MOS transistors of the CMOS driver circuits 36 and 37 become "H" and the signals d and g to respective N channel MOS transistors become "L". Consequently, all the MOS transistors of the P channel and N channel are in OFF state and the output e and h from the respective CMOS driver circuits 36 and 37 are in high impedance state as shown in Fig. 14E and Fig. 14H for example. At this moment, the power supply from the power supply circuit 30 is stopped or cut off.

Thus, the aforementioned output enable signal a is made "L" when the reproduction head 11 of the rotary head block 10 in Fig. 12 is in reproduction operation state. That is, in a case when a plurality of reproduction heads are provided, at least one of the reproduction heads is in reproduction operation state.

As the power supply is stopped during a reproduction operation of a reproduction head, the power used during this reproduction is obtained by utilizing an electric charge discharged from a capacitor 16 connected to the rectifier circuit 15. In general, when a capacitor of capacitance C discharges for time t with a current i, the voltage change DV can be expressed as follows.

$$\Delta V = - it/C$$

Here, a specific example will be considered, assuming, as shown in Fig. 15 and Fig. 16, that a reproduction period by a reproduction head is 10 ms; current $i = 10 \text{ mA}$; and a voltage drop from the full charge is up to 5V. In this case, if the capacitor 16 has a capacitance of $C = 20 \text{ } \mu\text{F}$, the voltage drop can be suppressed to 5V. For example, if the voltage after stabilized by the regulator 17 is 5V, it is possible to supply power without any problem. Fig. 16A shows the aforementioned output enable signal of the power supply; Fig. 16B shows a power signal transmitted via the rotary transformer; and Fig. 16C shows an output voltage a after rectification and a voltage b after voltage stabilization by the regulator 17. As is clear from the stabilized power source output voltage b shown in Fig. 16C, even if the power supply via the rotary transformer is cut

off during a reproduction operation period, the accumulated charge of the capacitor 16 can continuously supply power to the reproduction amplifier.

Now, the rectifier circuit 15 in the aforementioned Fig. 12 is, for example, a full-wave rectification circuit using four diodes bridged, but it is also possible to use a voltage doubling rectifier which doubles a voltage during rectification. Fig. 17 shows such a voltage doubling rectifier circuit. In the voltage doubling rectifier circuit 19 of this Fig. 17, when an input voltage v supplied via the rotary side winding 21b of the rotary transformer is positive, a diode D_1 is turned ON and a charge voltage v_{C1} of a capacitor C_1 becomes almost the aforementioned voltage v , and when the aforementioned input voltage v is negative, a diode D_2 is turned ON and a charge voltage v_{C2} of a capacitor C_2 becomes almost the aforementioned voltage v , thus generating in a capacitor C_3 a voltage v_{C3} which is almost $2v$.

By employing this voltage doubling rectifier circuit 19, the output voltage fed from the aforementioned power supply circuit 30 of fixed side can be $1/2$ of the voltage required in an ordinary full-wave rectifier circuit.

Here, in order to suppress the supply voltage at the fixed side to a lower level, as shown in Fig. 18C, it is possible to carry out a so-called step up by utilizing the winding ratio in the rotary transformer. That is, Fig. 18A shows a case of an ordinary power supply as in Fig. 12; Fig. 18B shows a case using a voltage doubling rectifier circuit as explained with reference to Fig. 17; and Fig. 18C shows a case of output voltage step-up by making the winding ratio of the rotary transformer as: fixed side winding 0.5 : rotary side winding 1.

However, in the case of Fig. 18C, the fixed side winding 21a of the rotary transformer becomes $1/2$ of the ordinary turns, decreasing the inductance of the transformer to $1/4$ viewed from the aforementioned power supply circuit 30. This is because, originally, in order to increase the transmission efficiency of the rotary transformer, both of the primary and the secondary windings of the transformed need to increase inductance, and each of the windings 21a and

Next, description will be directed to a winding arrangement for respective channels in the rotary transformer with reference to Fig. 21.

Fig. 21 shows a winding arrangement in the rotary transformer 20 in a case when using two recording channels and two reproduction channels. In this Fig. 21, the fixed side core 20a is arranged so as to oppose to the rotary side core 20b. Each of the cores 20a and 20b has 5 pairs of concentric grooves, respectively opposing to each other, so that in these 5 pairs of grooves, there are provided in the direction from the centre toward the outer circumference, a winding 21 for power transmission, windings 22 and 23 for reproduction signal transmission, and windings 24 and 25 for recording signal transmission.

This arrangement can be explained as follows. Firstly, within a transformer, there is a large cross talk between channels, normally causing a signal of 1/10 size leaking to an adjacent channel. In the aforementioned embodiment of the present invention, transmission of a power signal is halted during a reproduction operation and there is no adverse affect of the cross talk from the power signal to the reproduction channel. This enables to arrange a power channel and a reproduction channel in a vicinity to each other and it becomes important to isolate the power channel from the recording channel. Consequently, it is preferable to arrange the power channel, reproduction channel, and recording channel in this order in the radial direction of the rotary transformer. Next, as the head is provided in the vicinity of the outer circumference of the rotary drum and the channel located closer to the outer circumference is closer to the head. Therefore, the power channel is arranged at the innermost circumference, which is followed by the reproduction channel and the recording channel toward the outer circumference. Fig. 21 shows the arrangement thus determined.

Thus, the arrangement of channel windings of Fig. 21 enables to minimize signal leak from the power channel to the head. Furthermore, as the power channel is at the innermost circumference of the rotary transformer, there

21b has winding turns of the upper possible limit.

Consequently, when obtaining the aforementioned step-up ratio of 2, there is no other way than to decrease the number of turns of the fixed side winding 21c of Fig. 18C to 1/2 of the upper limit. Thus, the number of turns is reduced to 1/2 and the inductance is reduced to 1/4.

Fig. 19 shows a circuit equivalent to the power supply circuit 30 of the aforementioned Fig. 12 and the rotary transformer. In this Fig. 19, if the power supply circuit 30 has an output R, a high pass filter (HPF) is formed between the power supply circuit 30 and the inductance L of the transformer, lowering the power transmission efficiency in a lower frequency. This HPF has a cut-off frequency which can be expressed as follows:

$$f_0 = R/(2\pi L)$$

and the HPF has a transmission characteristic as shown in Fig. 20. In this Fig. 20, $\omega_c = 2\pi f_0$.

In an ordinary helical scan recording/reproduction system such as a so-called DAT (digital audio tape recorder) and a digital VTR, the recording/reproduction signal frequency band is normally from 1 MHz to several tens of MHz. In order to suppress the affects of the power transmission signal to the recording/reproduction channels, it is advantageous to use for the power transmission signal a frequency as low as possible. However, there is a problem that if the transformer is stepped-up as explained above, the lower limit of the power transmission frequency is lowered.

In contrast to this, when the aforementioned voltage doubling rectifier circuit 19 is used, it is possible to decrease the output voltage from the power supply circuit 30 to 1/2 without affecting to the (lower) limit of the power transmission frequency. This brings about various merits as follows. The power supply circuit 30 can have a low power source voltage, which in turn lowers the voltage transmitted via the rotary transformer, enabling to minimize intervention via air into the recording/reproduction system as well as reducing the cross talk in the rotary transformer.

is an advantage that a wire connecting the aforementioned power supply circuit 30 and the winding of the rotary transformer can be passed in the vicinity of the drum shaft, without intersecting the recording/reproduction signal wires.

5 It should be noted that the present invention is not to be limited to the aforementioned embodiment. For example, the rotary block of the rotary head apparatus may be rotary disc type other than the rotary drum and can have only a reproduction head, or both of a reproduction head and a
10 recording head, or a recording/reproduction head. Moreover, the voltage doubling rectifier circuit may have a configuration other than the one shown in the figure, and the voltage may be multiplied not only by 2 but also 3, 4, and the like. The present invention can be modified in various
15 ways within departing from the scope of the invention.

 As is clear from the above explanation, according to the present invention, a signal recorded on a tape-shaped recording medium is reproduced by a reproduction head of a
20 rotary head block intermittently according to a rotation and a reproduction signal from the reproduction head is taken out via a rotary transformer, wherein the rotary head block is provided with a reproduction initial stage amplifier for amplifying a signal from the reproduction head, a rectifier circuit, and power accumulation means, so that during a non
25 reproduction operation period of the reproduction head, a power signal is supplied via the rotary transformer to the rectifier circuit, so as to supply a rectified output power from the rectifier circuit to the reproduction initial stage amplifier and to the power accumulation means; and during a
30 reproduction operation of the reproduction head, an accumulated power from the power accumulation means is supplied to the reproduction initial stage amplifier. That is, no power transmission is carried out during a reproduction channel signal transmission, preventing an
35 adverse affect of the power transmission signal to the reproduction head output.

 Moreover, as the rectifier circuit of the rotary head block is a voltage doubling rectifier circuit for multiplying an input voltage for output, which enables to

reduce an output voltage of a power source, reducing the load of the power supply circuit and minimizing the affect to a recording/reproduction system.

Furthermore, as the rotary transformer, a plurality
5 of pairs of windings in a single transformer transmit signals of all the channels to the aforementioned rotary head block and the channels are arranged in the order of a power signal, a reproduction signal, and a recording signal from the inner circumference toward the outer circumference, so that the
10 recording channel is at the farthest position from the power channel, enabling to minimize the affect to the recording channel.

CLAIMS

1. A signal reproduction apparatus comprising:
5 a rotary head block including: a reproduction head along which, in use, a tape-shaped recording medium is applied, so that at least reproduction operation is carried out intermittently according to the rotation; a reproduction initial stage amplifier connected to said reproduction head;
10 a rectifier circuit for supplying electric power to said reproduction initial stage amplifier; and power accumulation means for accumulating electric power to be supplied from said rectifier circuit to said reproduction initial stage amplifier and supplying accumulated power to said
15 reproduction initial stage amplifier when no power is supplied from said rectifier circuit;
a rotary transformer for transmitting at least an output signal of said reproduction initial stage amplifier from said rotary head block and a power signal to said
20 rectifier circuit; and
a power supply circuit for supplying said electric signal to said rotary transformer and stops the supply of said power signal during a reproduction operation of said reproduction head of said rotary head block.
25
2. A signal reproduction apparatus as claimed in Claim 1, wherein a recording head is mounted on said rotary head block and a recording operation by said recording head and a reproduction operation by said reproduction head are carried
30 out without any temporal overlap.
3. A signal reproduction apparatus as claimed in Claim 2, wherein said rotary transformed has a power signal channel, a reproduction signal channel, and a recording
35 signal channel, each consisting of a pair of windings, and said channels are arranged in the order of the power signal channel, the reproduction signal channel, and the recording signal channel from the inner circumference in the radial direction of said rotary transformer.

4. A signal reproduction apparatus as claimed in Claim 1, 2 or 3, wherein said rectifier circuit is a voltage doubling rectifier circuit for multiplying an input voltage and outputting a multiplied voltage.

5
5. A signal reproduction method for reproducing a signal recorded on a tape-shaped recording medium by a reproduction head of a rotary head block and taking out a reproduction signal from said reproduction head via a rotary transformer,

10 said rotary head block including: a reproduction initial stage amplifier for amplifying a signal from said reproduction head, a rectifier circuit, and power accumulation means,

15 wherein
during a non-reproduction operation period of said reproduction head, a power signal is supplied via said rotary transformer to said rectifier circuit and a rectified output power from said rectifier circuit is supplied to said
20 reproduction initial stage amplifier and accumulated in said power accumulation means, and

25 during a reproduction operation of said reproduction head, an accumulated power from said power accumulation means is used to drive said reproduction initial stage amplifier.

6. A signal reproduction apparatus substantially as hereinbefore described with reference to and as illustrated in Figs. 12 to 21 of the accompanying drawings.

30
7. A signal reproduction method substantially as hereinbefore described with reference to and as illustrated in Figures 12 to 21 of the accompanying drawings.

35



Application No: GB 9811968.8
Claims searched: 1 to 5

Examiner: Peter Easterfield
Date of search: 26 October 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): G5R (RB35, RB84, RKL, RKY)

Int Cl (Ed.6): G11B 5/52, 5/53, 20/24

Other: Online: WPI, JAPIO, CLAIMS

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2272100 A (SAMSUNG)	
A	GB 2191327 A (MITSUMI)	
A	EP 0660305 A2 (TOSHIBA)	
A	US 4851935 A (OHYAMA et al)	
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